Claims

1. An electronic proximity sensing apparatus, comprising:

at least two pair of signal pads, each pair of signal pads comprising a first signal pad and a second signal pad, each signal pad connected to receive an electric voltage signal;

at least two sensing conductors routed between the first signal pads and the second signal pads of the at least two pair of signal pads; and

a sensor operable to detect the difference in voltage between two of the at least two sensing conductors.

2. The electronic proximity sensing apparatus of claim 1, wherein the first signal pad and the second signal pad of each pair are connected to receive electric voltage signals that vary inversely to one another.

3. The electronic proximity sensing apparatus of claim 1, wherein the electric voltage applied to each pair of the at least two pair of signal pads varies only when the voltage applied to other pair of the at least two pair of signal pads remains substantially constant.

4. The electronic proximity sensing apparatus of claim 1, wherein the at least two sensing conductors comprise printed circuit board traces that are substantially parallel to each other, and wherein the at least two pair of signal pads comprise signal pads

comprising printed circuit board traces running substantially parallel to one another and to the at least two sensing conductors.

5. The electronic proximity sensing apparatus of claim 1, wherein the at least two sensing conductors are physically separated by a ground conductor at a ground potential voltage.

6. The electronic proximity sensing apparatus of claim 1, wherein the at least two sensing conductors comprise at least three sensing conductors, and wherein the sensor comprises:

a first sensor operable to detect a voltage between a first of the at least three sensing conductors and a second of the at least three sensing conductors and to output a voltage signal proportional to the detected voltage;

a second sensor operable to detect a voltage between the second of the at least three sensing conductors and a third of the at least three sensing conductors and to output a voltage signal proportional to the detected voltage; and

a third sensor operable to detect a difference between the voltages output by the first sensor and the second sensor, and to output a voltage signal proportional to the detected voltage difference.

7. The electronic proximity sensing apparatus of claim 1, wherein the electronic proximity sensing apparatus comprises part of a position selector apparatus, and

wherein each pair of signal pads represents a position of the position selector apparatus.

8. The electronic proximity sensing apparatus of claim 1, further comprising at least two visual indicators associated with the at least two pair of signal pads, the visual indicators configured to provide visual indication of signal pads actuated by proximity sensing.

9. The electronic proximity sensing apparatus of claim 1, further comprising a circuit coupled to the sensor for comparing the detected voltage difference to an anticipated voltage difference to determine proximity of a capacitive body.

10. The electronic proximity sensing apparatus of claim 9, wherein a detected voltage difference significantly lower than the anticipated voltage difference indicates proximity of a capacitive body.

11. The electronic proximity sensing apparatus of claim 9, wherein the capacitive body is part of a human body.

12. The proximity sensing apparatus of claim 1, comprising multiple proximity sensing apparatus configured to form a two-dimensional touchpad proximity sensing apparatus.

13. The proximity sensing apparatus of claim 1, wherein sensing proximity comprises determining whether an object is proximate or not proximate.

14. The proximity sensing apparatus of claim 1, wherein sensing proximity comprises determining a varying degree of proximity of an object.

15. The proximity sensing apparatus of claim 1, wherein the sensing proximity comprises evaluation of proximity sensing data from at least two of the at least two pair of signal pads to provide an interpolated detected proximity location.

16. The proximity sensing apparatus of claim 1, further comprising an audio synthesizer, wherein the proximity sensing apparatus is coupled to the proximity sensor such that the proximity sensor is operable to control one or more synthesizer parameters.

17. An electronic proximity sensing apparatus, comprising:

at least one signal pad, each signal pad configured to receive an electric voltage signal;

at least two sensing conductors physically positioned in proximity to the at least one signal pad, the sensing conductors not in electrical contact with the at least one signal pad; and

a sensor operable to detect the difference in voltage between two of the at least

two sensing conductors, thereby sensing proximity of an object.

18. The electronic proximity sensing apparatus of claim 17, wherein the at least one signal pad comprises a first and second signal pad forming a pair, and wherein the at least two sensing conductors are routed between the first and second signal pad.

19. A method of sensing proximity of an object, comprising:

providing an electrical signal to at least two pair of signal pads, each pair of signal pads comprising a first signal pad and a second signal pad; and

sensing a difference in voltage between at least two sensing conductors routed between the first signal pads and the second signal pads of the at least two pair of signal pads.

20. The method of sensing proximity of an object of claim 19, wherein the first signal pad and the second signal pad of each pair are provided electric voltage signals that vary inversely to one another.

21. The method of sensing proximity of an object of claim 19, wherein the electrical signal provided to each pair of the at least two pair of signal pads varies only when the electrical signal applied to other pair of the at least two pair of signal pads remains substantially constant.

22. The method of sensing proximity of an object of claim 19, wherein the at least two sensing conductors comprise printed circuit board traces that are substantially parallel to each other, and wherein the at least two pair of signal pads comprise signal pads comprising printed circuit board traces running substantially parallel to one another and to the at least two sensing conductors..

23. The method of sensing proximity of an object of claim 19, wherein the at least two sensing conductors are physically separated by a ground conductor at a ground potential voltage.

24. The method of sensing proximity of an object of claim 19, wherein the at least two sensing conductors comprise at least three sensing conductors, and wherein the sensor comprises:

a first sensor operable to detect a voltage between a first of the at least three sensing conductors and a second of the at least three sensing conductors and to output a voltage signal proportional to the detected voltage;

a second sensor operable to detect a voltage between the second of the at least three sensing conductors and a third of the at least three sensing conductors and to output a voltage signal proportional to the detected voltage; and

a third sensor operable to detect a difference between the voltages output by the first sensor and the second sensor, and to output a voltage signal proportional to the detected voltage difference.

25. The method of sensing proximity of an object of claim 19, wherein the at least two pair of signal pads and the at least two sensing conductors comprise part of a position selector apparatus, and wherein each pair of signal pads represents a position of the position selector apparatus.

26. The method of sensing proximity of an object of claim 19, further comprising operating at least two visual indicators associated with the at least two pair of signal pads to provide visual indication of actuation of the signal pads by proximity sensing.

27. The method of sensing proximity of an object of claim 19, further comprising comparing the detected voltage difference to an anticipated voltage difference to determine proximity of a capacitive body.

28. The method of sensing proximity of an object of claim 27, wherein determining proximity of a capacitive body when a detected voltage difference significantly lower than the anticipated voltage difference is detected.

29. The method of sensing proximity of an object of claim 27, wherein the capacitive body is part of a human body.

30. The method of sensing proximity of an object of claim 19, wherein the signal pads and sensing conductors are configured to form a two-dimensional touchpad proximity

sensing apparatus.

31. The method of sensing proximity of an object of claim 19, wherein sensing proximity comprises determining whether an object is proximate or not proximate.

32. The method of sensing proximity of an object of claim 19, wherein sensing proximity comprises determining a varying degree of proximity of an object.

33. The method of sensing proximity of an object of claim 19, wherein the sensing proximity comprises evaluation of proximity sensing data from at least two of the at least two pair of signal pads to provide an interpolated detected proximity location.

34. A method of sensing proximity of an object, comprising:

providing a changing electric voltage signal to at least one signal pad; and

detecting a difference in voltage between two of at least two sensing conductors routed substantially parallel to one another and in proximity to the at least one signal pad, the sensing conductors not electrically coupled to the at least one signal pad.

35. The method of sensing proximity of an object of claim 34, wherein the at least one signal pad comprises a first and second signal pad forming a pair, and wherein the at least two sensing conductors are routed between the first and second signal pad.

36. An electronic proximity sensing apparatus, comprising:

at least two sensing pads, the at least two sensing pads being substantially similar in size and configuration to one another;

at least one signal source, the signal source either electrically coupled to at least one of the two sensing pads or coupled to at least one signal pad in proximity to the at least two sensing pads; and

a sensor operable to detect the difference in voltage between two of the at least two sensing pads, thereby sensing proximity of an object.

37. The electronic proximity sensing apparatus of claim 36, wherein the at least two sensing pads are in proximity to each other relative to the size of the object which the proximity sensing apparatus is configured to sense.

38. The electronic proximity sensing apparatus of claim 37, wherein the at least two sensing pads are closer in distance than the approximate width of the object to be sensed.

39. The electronic proximity sensing apparatus of claim 37, wherein the object the electronic proximity sensing apparatus is configured to sense is a human finger.

40. The electronic proximity sensing apparatus of claim 36, wherein the at least two sensing pads are in proximity to the at least one signal pad relative to the approximate

size of the object the electronic proximity sensing apparatus is configured to sense.

41. The electronic proximity sensing apparatus of claim 40, wherein the at least two sensing pads and the at least one signal pad are closer in distance than the approximate width of the object to be sensed.

42. The electronic proximity sensing apparatus of claim 40, wherein the object the electronic proximity sensing apparatus is configured to sense is a human finger.

43. The electronic proximity sensing apparatus of claim 36, wherein the at least one signal source comprises an oscillator signal coupled via a resistor to at least one of the at least two sensing pads.

44. The electronic proximity sensing apparatus of claim 36, wherein the at least one signal source comprises at least one charge transfer circuit coupled to at least one of the at least two sensing pads.

45. The electronic proximity sensing apparatus of claim 44, wherein the at least one signal source further comprises a second charge transfer circuit coupled to at least a second of the at least two sensing pads.

46. The electronic proximity sensing apparatus of claim 36, wherein the sensor

comprises a sense amplifier connected to each of the at least two sensing pads.

47. The electronic proximity sensing apparatus of claim 46, wherein the sense amplifiers are each configured to have a substantially similar input impedance.

48. The electronic proximity sensing apparatus of claim 46, wherein the sense amplifiers are gain-adjusted to amplify common mode noise sensed via the coupled sense pads by substantially the same amount.

49. The electronic proximity sensing apparatus of claim 36, wherein the at least two sensing pads comprise at least three sensing pads, and wherein the sensor comprises:

a first sensor operable to detect a voltage between a first of the at least three sensing pads and a second of the at least three sensing pads and to output a voltage signal proportional to the detected voltage;

a second sensor operable to detect a voltage between the second of the at least three sensing pads and a third of the at least three sensing pads and to output a voltage signal proportional to the detected voltage; and

a third sensor operable to detect a difference between the voltages output by the first sensor and the second sensor, and to output a voltage signal proportional to the detected voltage difference.

50. A method of detecting proximity of a capacitive object, comprising:

providing an electric stimulus signal to a region having least two sensing pads;

sensing an electric signal from a first sensing pad, the electric signal indicating proximity of a capacitive body;

sensing an electric signal from a second sensing pad, the second sensing pad located physically near the first sensing pad and similar in physical configuration to the first sensing pad, and the electric signal indicating proximity of a capacitive body; and

differentially combining the sensed electric signals from the first sensing pad and the second sensing pad such that common mode noise is reduced.